

UNDERSTANDING RADIOACTIVITY IN SOIL AT HUNTERS POINT SHIPYARD

1. HOW DO WE MEASURE RADIOACTIVITY IN SOIL?

To measure radioactivity in soil, a trained technician collects small soil samples. The soil samples are then taken to a laboratory where they are placed in a radioisotope detector. The radioisotope detector measures radioactivity in a unit of measure called curies. One curie is the quantity of radioactive material that will have 37,000,000,000 (3.7×10^{10} or 3.7×10^{10}) changes, called transformations, in one second. Curies in soil are usually measured in smaller curie units like thousandths (10^{-3} or millicurie or mCi), millionths (10^{-6} or microcurie or uCi), billionths (10^{-9} or nanocurie or nCi), or trillionths (10^{-12} or picocurie or pCi) of a curie.

2. WHAT ARE THE RADIOACTIVE CLEANUP GOALS FOR SOIL AT HPS?

The radioactive cleanup goals in soil at Hunters Point Shipyard (HPS) are:

RADIONUCLIDE	OUTDOOR WORKER	RESIDENTIAL
Cesium-137	0.113 pCi/g	0.113 pCi/g
Radium-226	1.0* pCi/g	1.0* pCi/g
Strontium-90	10.8 pCi/g	0.331 pCi/g

The above numbers are measured in picocuries per gram (pCi/g) for soil. Cesium-137 (Cs-137), strontium-90 (Sr-90) and radium-226 (Ra-226) are the three most commonly measured types of radioactive material in soil at HPS.

* Because Ra-226 is naturally occurring, radium levels are measured at one pCi/g above background levels. For the sanitary/storm sewer removal action, the background level of Ra-226 at HPS has been determined to be 0.485 pCi/g. Therefore the release limit for Ra-226 for the sewer removal project is 1.485 pCi/g. This release limit includes radium-226 that is naturally occurring in the soil.

3. HOW IS DOSE MEASURED?

The dose is measured in rem, which is a unit used to quantify the biological effect on tissue. Dose in rem is often expressed in terms of thousandths of rem or millirem (mrem) or millionths of rem or microrem (urem).

4. HOW DO YOU COMPARE RADIOACTIVITY LEVELS IN SOIL WITH RADIATION DOSE?

The dose is normally quantified over a period of time; i.e., mrem per year (mrem/yr) or mrem per hour (mrem/hr). The amount of dose from the radioactivity in the soil can be lessened by shortening the time spent in proximity to the radioactivity, increasing the distance away from the

radioactivity, and putting material (shielding) between the person and the soil with the radioactivity.

5. WHAT ARE THE DOSE RELEASE GOALS AT HUNTERS POINT?

For Hunters Point, the dose from the release limit in pCi/g has been derived for two categories: outdoor worker and residential. The dose for an outdoor worker would differ from that of a full-time resident as the amount of time the person would be exposed to the radioactive material and the methods of exposure would be different. The following lists the dose in mrem/year for the release limits listed above:

RADIONUCLIDE	OUTDOOR WORKER	RESIDENTIAL
Cesium-137	0.2142	0.2561
Radium-226	6.342	14.59
Strontium-90	0.1931	1.648

6. HOW DO THESE DOSE LEVELS COMPARE WITH RADIATION DOSES IN EVERYDAY LIFE?

These dose levels can be compared to the dose all persons receive from radioactivity in their everyday life. This radioactivity can be from the sun and the atmosphere, naturally occurring radioactive materials in the earth, the houses we live in and the food we eat. Radioactive gases are mixed in the air we breathe and our bodies contain naturally occurring elements that are radioactive. This type of radiation exposure is called “natural background” and varies depending upon where and how we live. The average yearly dose to people in the U.S. from natural background radiation is 300 mrem. Additional dose is received from certain activities. These can include:

2.5 mrem	Cosmic radiation dose to a person on a one-way flight from New York to Los Angeles
0.5 mrem	X-rays from a television set one inch from the screen in one hour
8 mrem	Average dose from one chest x-ray
6 mrem	Average dose in one year from one pocket watch with a radium dial
39 mrem	Average dose in one year from naturally occurring radioisotopes in the body
3 mrem	Average dose in one year from building materials
5 mrem	Average dose in one year from drinking water
9 mrem	Average dose in one year from use of natural gas in the home

2 mrem	Average dose from sleeping next to someone every night for one year
<1 mrem	Average dose in one year to the public from weapons fallout
<0.1 mrem	Average dose in one year to the public from nuclear power

7. WHAT ARE THE LIMITS THE REGULATORS SET FOR MAN-MADE RADIATION?

The Nuclear Regulatory Commission has set the following limits for this type of exposure:

5 rem	Yearly limit for occupational radiation workers
100 mrem	Yearly limit for the general public